Notebook, N-88-03-15.2

This notebook covers the period March 1888-March 1889. There is also one entry for October 1889. All entries are by Edison. At the beginning of the book are notes regarding the production of aluminum by electrolysis. Most of the book contains drawings and draft patent caveats for the phonograph and for squirted lamp filaments. There are also calculations for an ore milling operation. The book contains 238 numbered pages and has been used in both directions. Several pages were removed from the front of the book before it was paginated.

Filming order: 1-159, 181-160, 188-238.

Blank pages not filmed: 102-109, 162-163, 182-187, 222-223, 232-233.

N-88-03-15.2

XE-5286

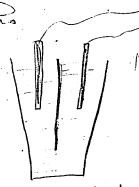
Notes on Experiments
for production of
Aluminum

March 15 1888.

TCE

Try Bunsens Electrolytic
process - Collis Die Vol I
page 152 - also see full
paper in Poggendorf Annalen
XCII. 648 Use the Electric
Light Carbon - If you succeed
in getting the results, then
rig up & make a quantitative
Experiment to determine how
much Material & Current
is used under the best
Condition per gramme
of aluminium - Try platinum
as well as Carbon Electrodes

instead of a porous partition
use a new porous partition &
leave an opening at the
bottom for the Current to
pass thro



You will have to fit it in the
sides of the Crucible.

Try also fused Carbonate
Soda - Carbon Electrodes
& then when liquid add
Chlorides of Alumina
Current Current as Oxygen
will be Eliminated at the Carbon

Space —

Vary this Experiment by using

~~Quantities of Elimination of Oxygen~~

~~and to a Carbon Pole~~

~~also Vary of Experiment~~

The following wires or Electrodes

Electrodes on which Oxygen is liberated

Iron
Nickel
Copper
Zinc
Silver
Cast Iron
Carbon
platinum
Brass
Cadmium

Electrodes on which the Base is liberated —

platinum
Iron
Nickel
Copper
Zinc
Silver
Cast iron
Carbon
platinum
Brass
Cadmium

Change these about in various ways —

Use the following solutions -

Chloride of Aluminium alone

Double Chloride of Aluminium + Sodium

Cryolite

Sulphide of Aluminium alone

Sulphate of Aluminium and Carbonate of Sodium in various proportions.

Sulphide of Soda & Chloride of Aluminium Various proportions

Sulphide of Soda + Sulphate of Aluminium

Sulphide of Soda - Acetate of Aluminia -

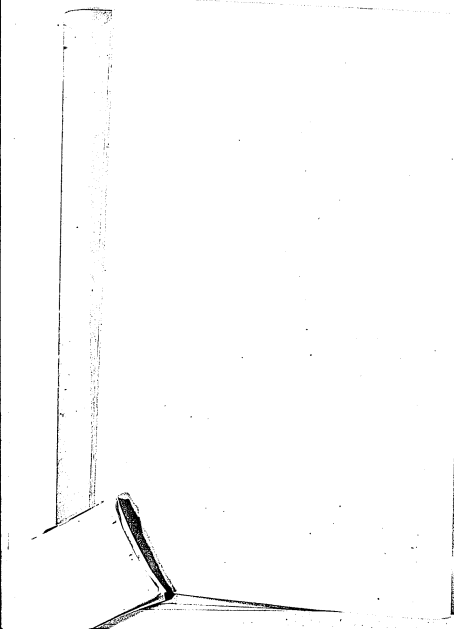
Sulphide of Sodium +
Carbonate of Aluminium

Chloride Sodium Carbonate
Sulphide Soda + Chloride of
Aluminium -

Caustic Soda + Chloride
Aluminium

Borax and Cyanide of
Aluminium -

Note - put pure Chloride Aluminum
anhydrous in side tube of lamp
32 cp + get vac heat aluminum Chloride
which when pure boils at 180°
+ volatilizes at low temperature
then heat filament - then will
probably not work - Their substitute
and now work - The Chlorine will
Combine with the if Vacuum
kept high + action go on slowly



aluminum nitral should be 6.13
deposited on the 4 tube —

Potassium Carbonate

Carbonate soda & Chr
double Chloride of
Aluminum & Sodium

Common Alum (12)
Potassium & Aluminum

Chrome alum

ammonia Alum

Chrome alum & Carbonate
soda —

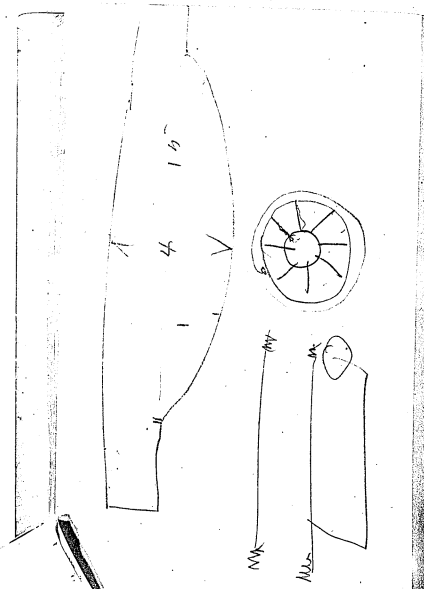
Ammonia Alum &
Carbonate soda

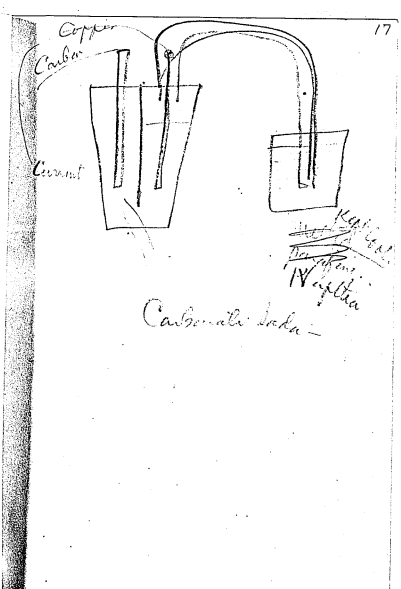
Potassium Alum & Carbonate Soda —

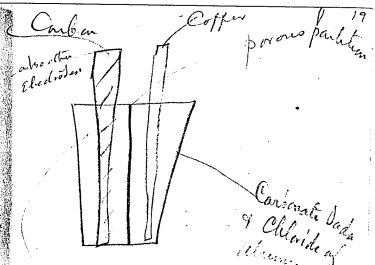
Note = See Joules method of Electrolytic preparation of Aluminum — Chem Gaz 1850 339 — perhaps found in Joules papers a book recently issued now in Library

Acetate Soda & Chloride Aluminum —

Chloride Aluminum 25 pct of its weight of Lampblack & Carbonate Soda —

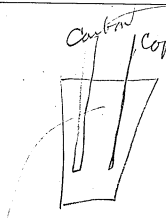



Copper
Carbon
Current
17
Carbonate soda



Carbonate Soda —
perhaps this will work very well for the partitions —

9m Electric Lamp 32 cp —
Bisulphide anhydrous
Chloride Aluminum + asphalt
pitch or Naphthalin, or heating
Chloride Aluminum + Naphthalin
Volatilized — heated filament
decomposes the Chl Aluminum
+ Chlorine Combines with
~~Carbon~~ Hydrogen to form HCl —



Use - anhydrous Chloride Alumina, 30 pct - 70 pct Carbonate Soda - fuse to red heat the Soda + then add the Chloride -

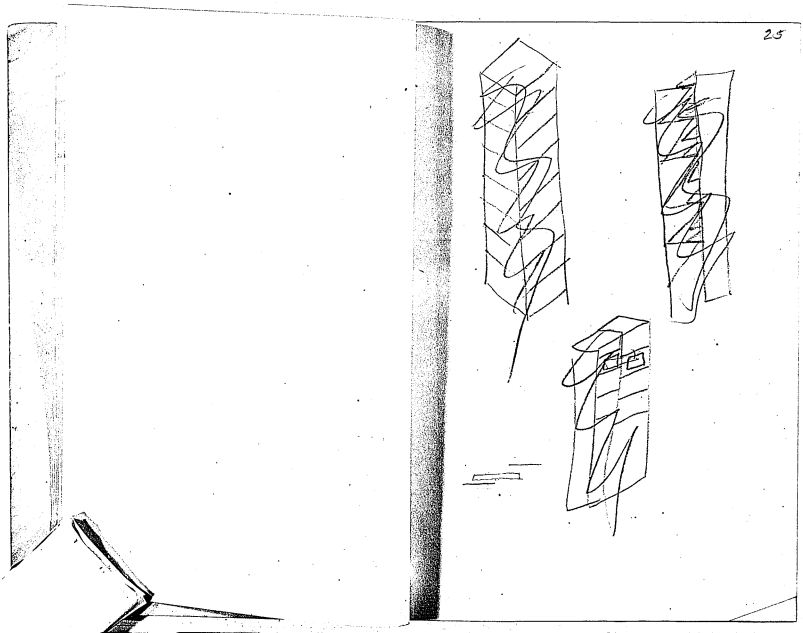
---

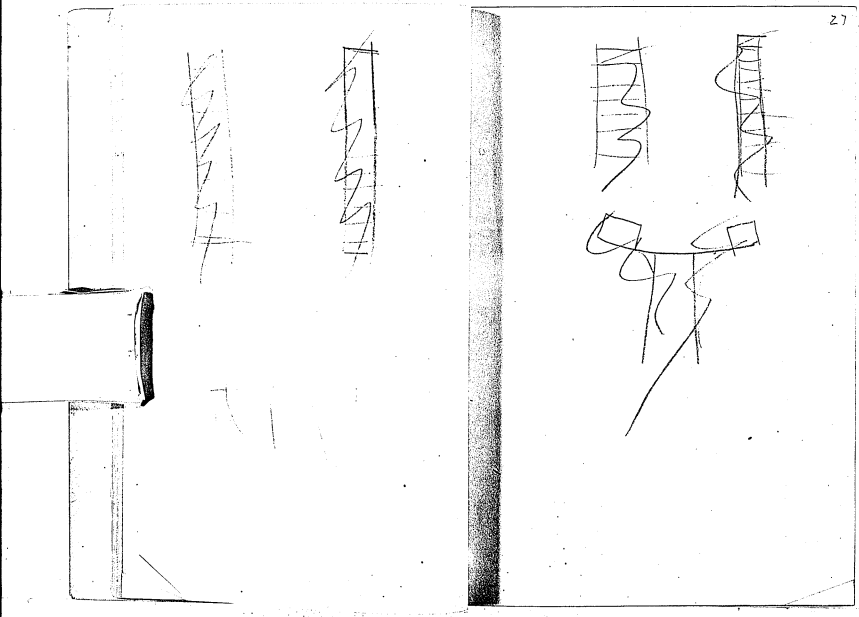
also use Chloride Aluminum + Carbonate potash

also use Double Chloride of Aluminum + Soda with ~~of Aluminum + Soda~~ potash

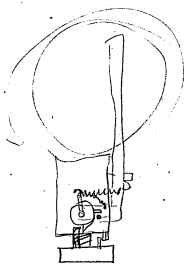
also double chloride of Al & K with excellent carbon

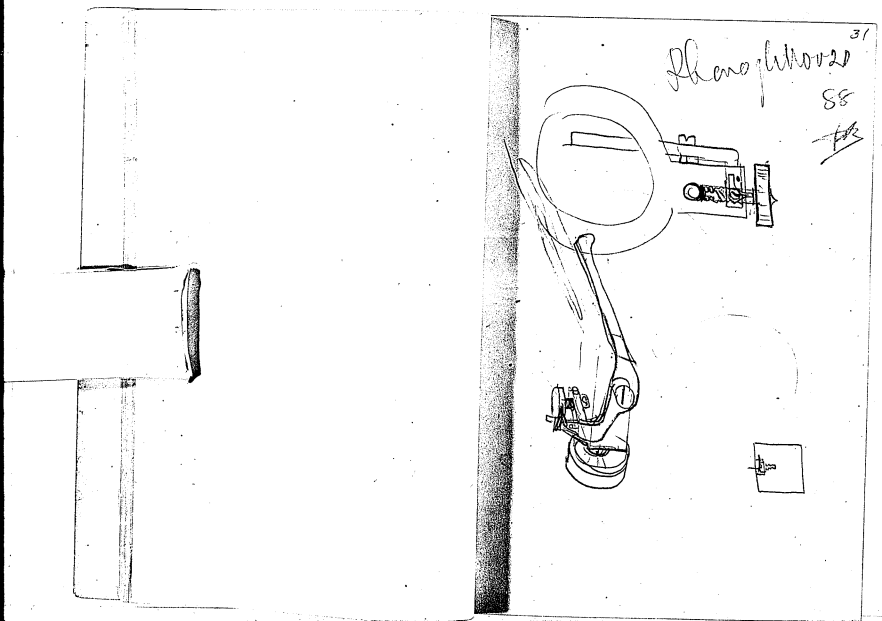
Look for deposit aluminum
on cotton or balloon
Crucible — ~~tantalum~~ Case
~~this~~ use as low a heat
as possible —

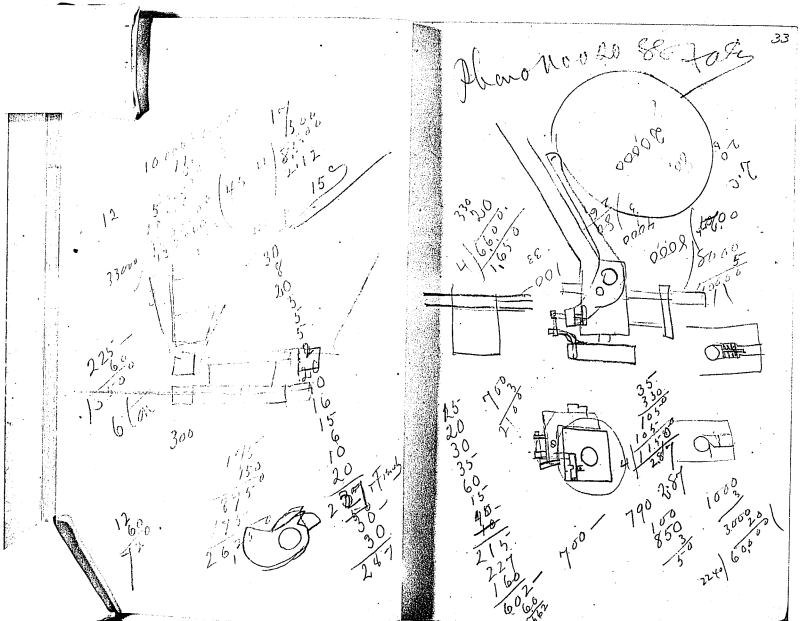


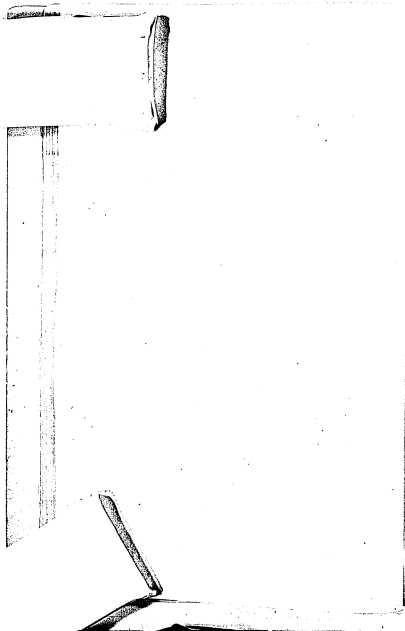


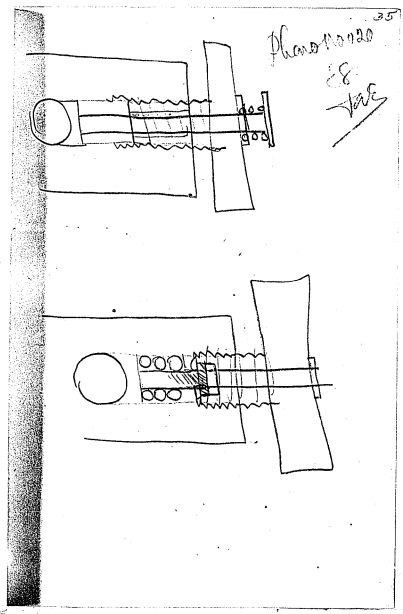
Phmgh Nov 20 85







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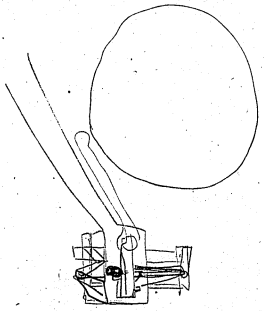
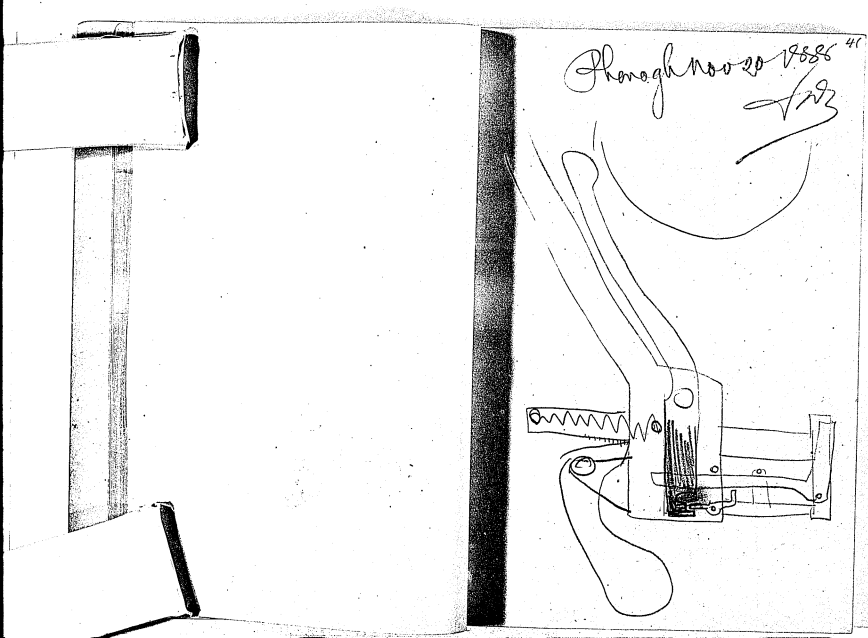
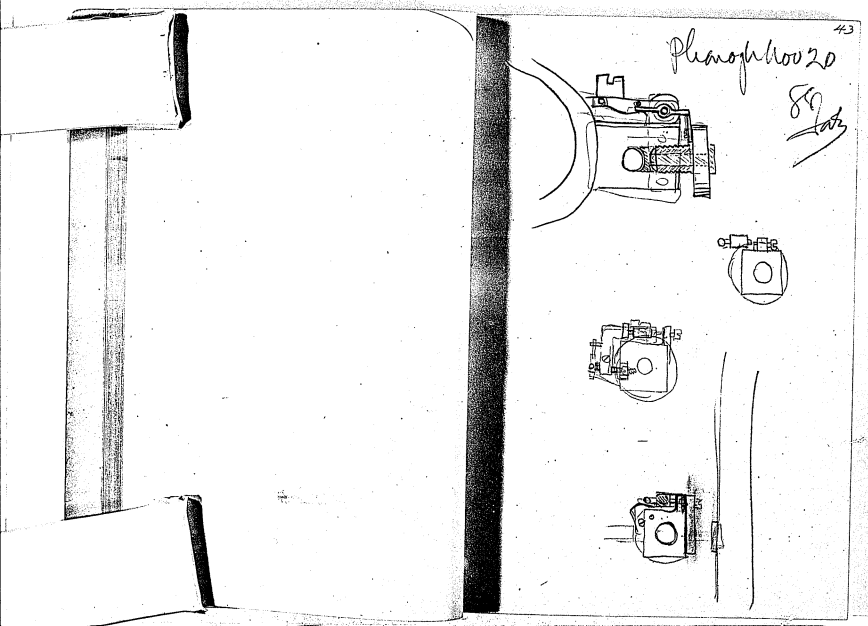
Year

Phonograph Nov 20-88

Photograph 20 SR



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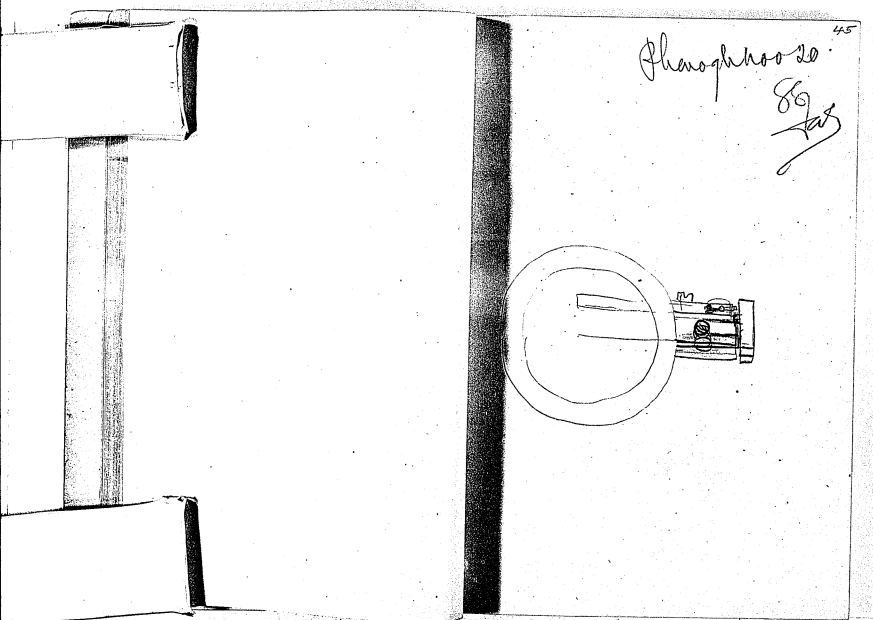
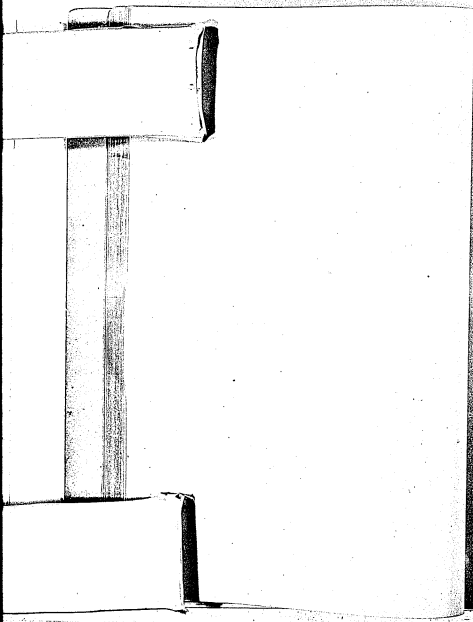
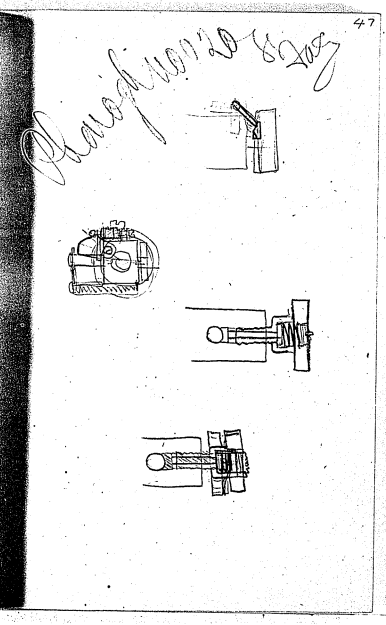
Phenophthoros.







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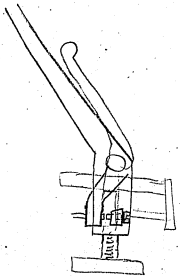

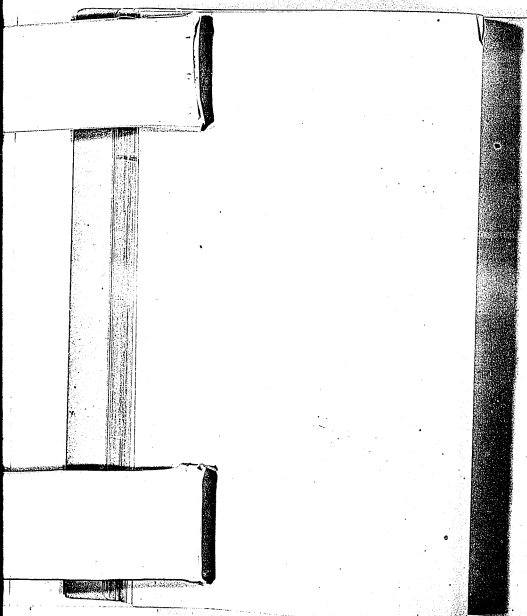

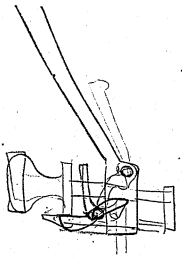

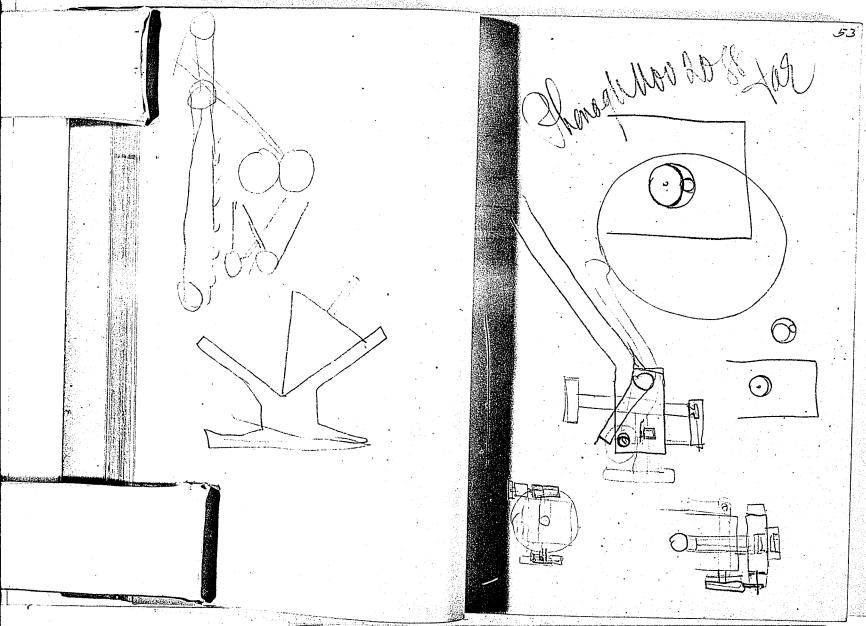

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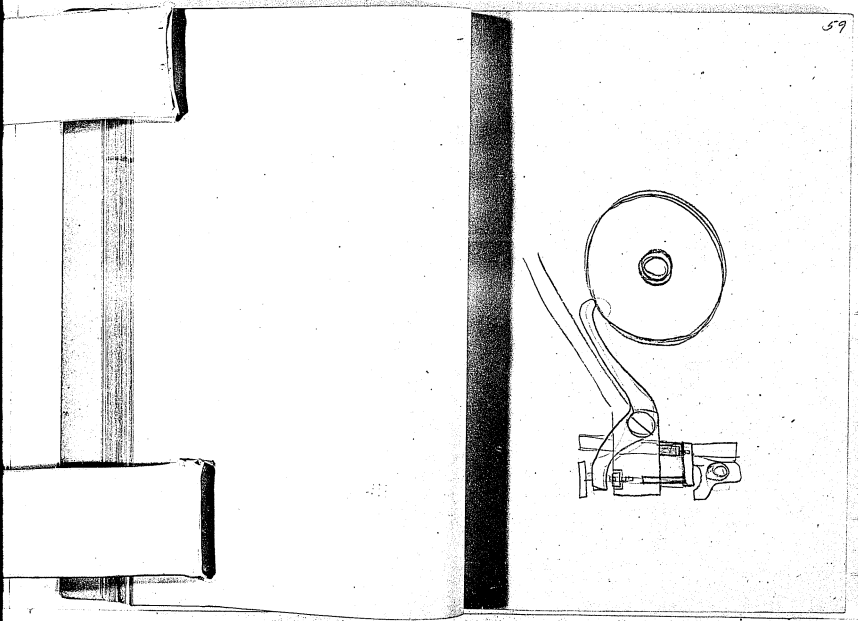
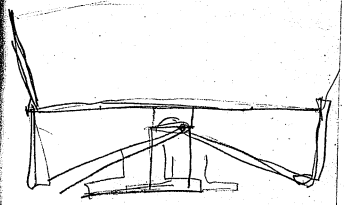
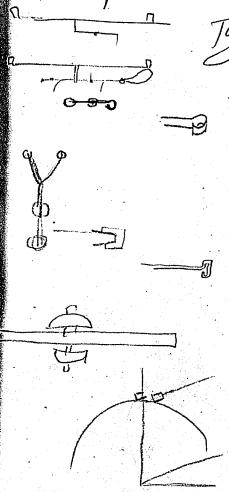
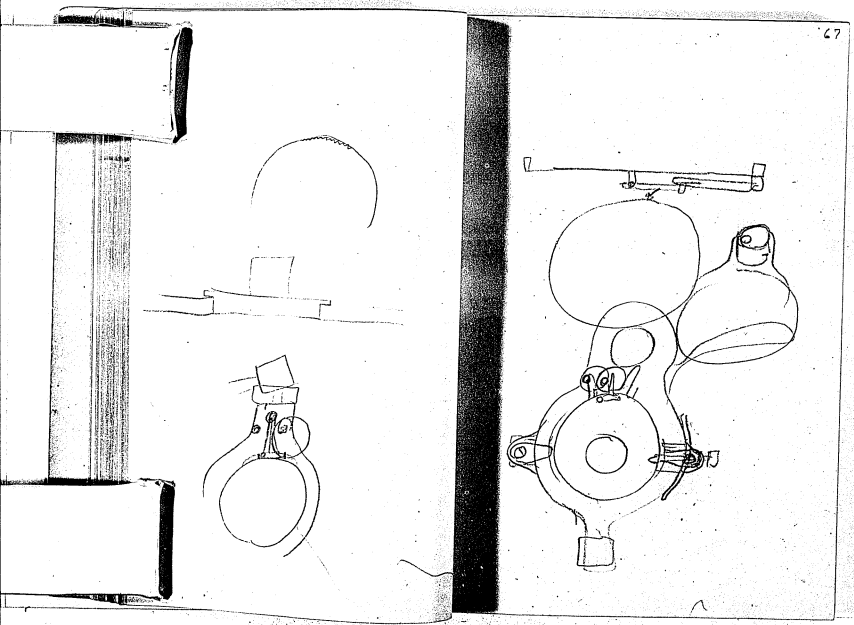
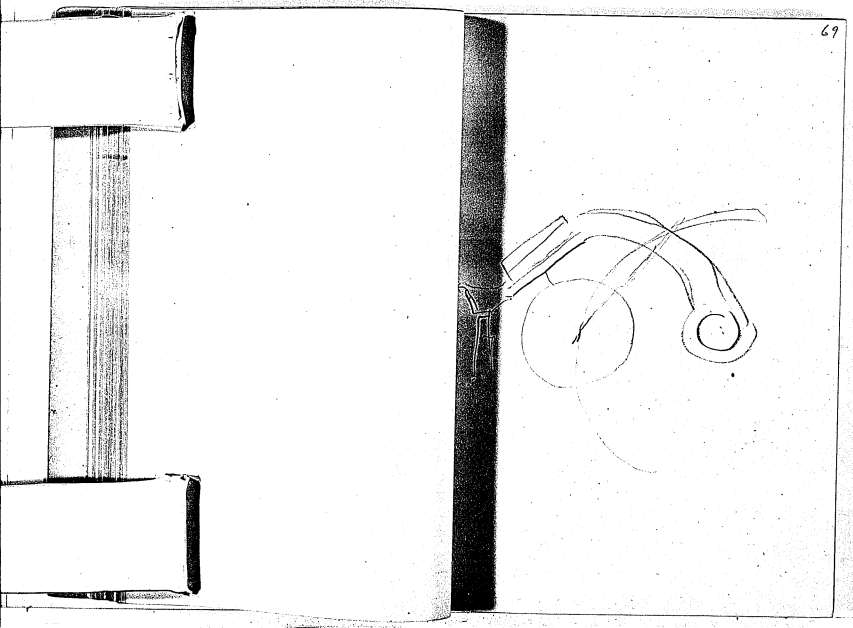


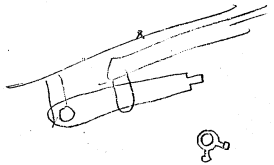


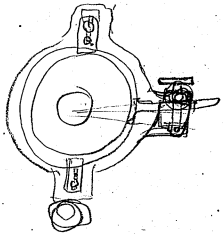
Plough Oct 10 89

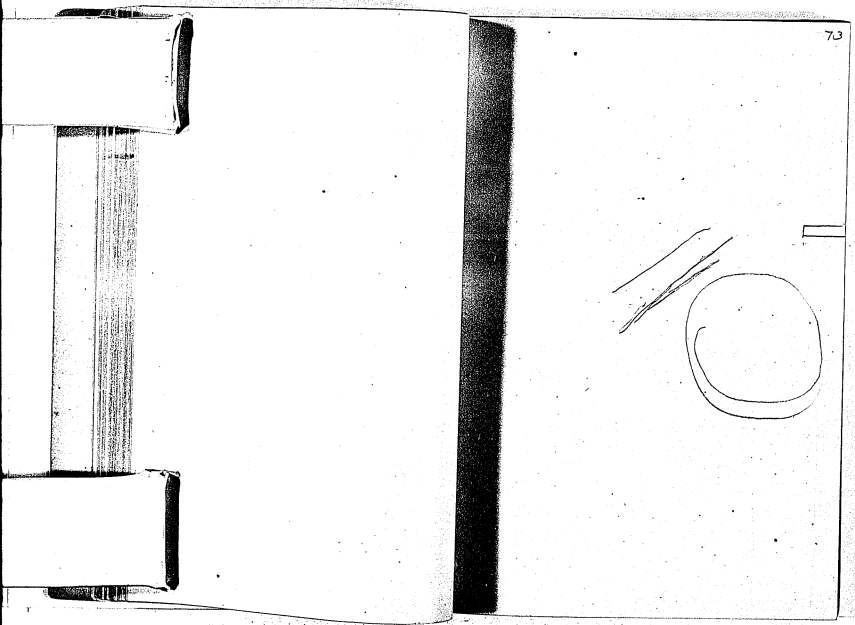








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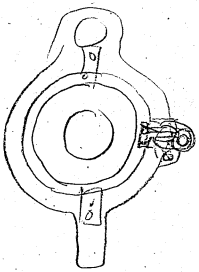
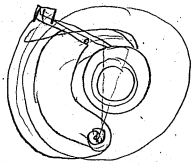
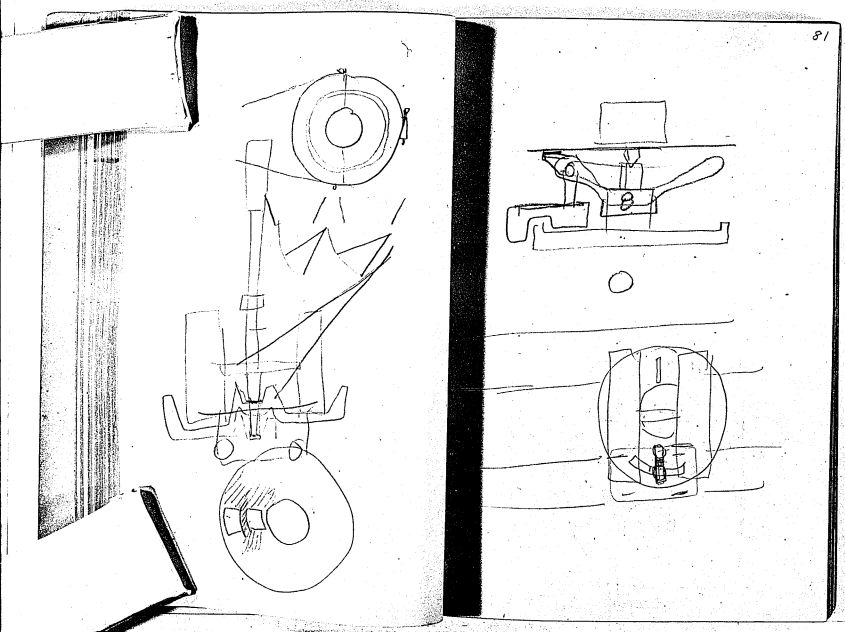
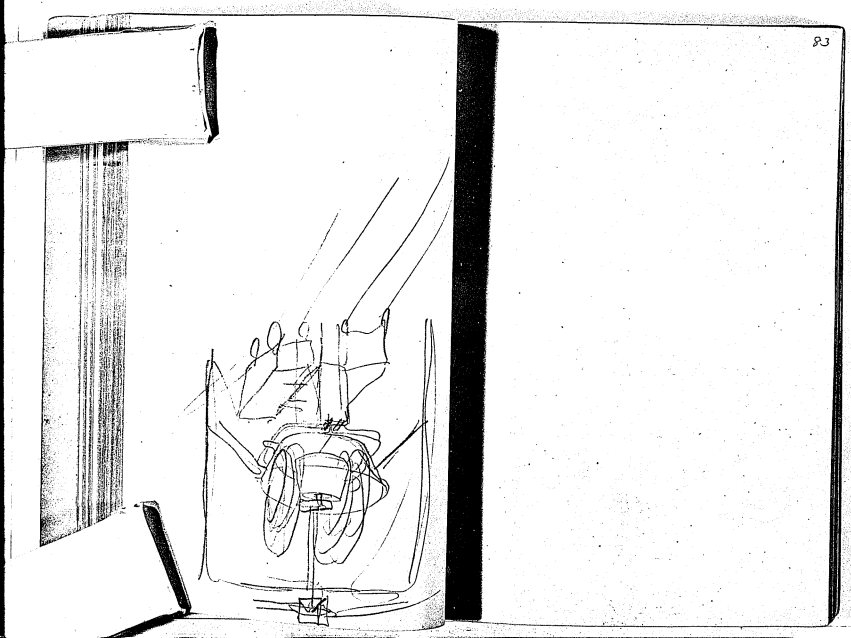


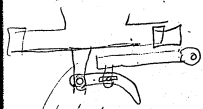


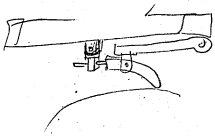


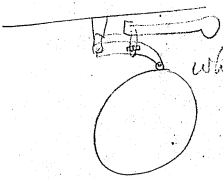


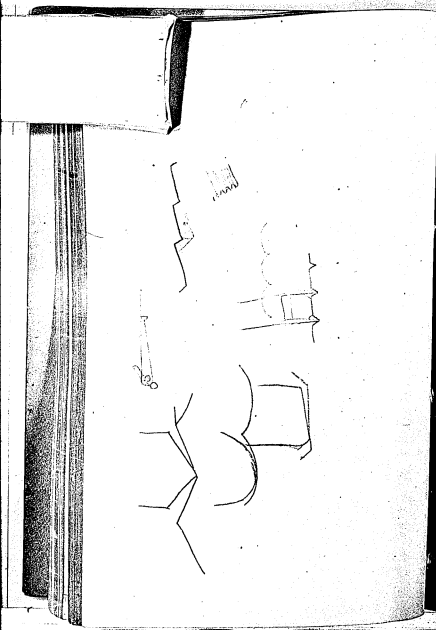
85
Lucretia Borgia
Medici
Lorenzo
Lorenzo
Lorenzo

Phonograph Caveat – E.D.
March 16 1889





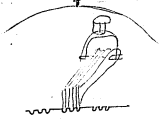


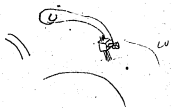


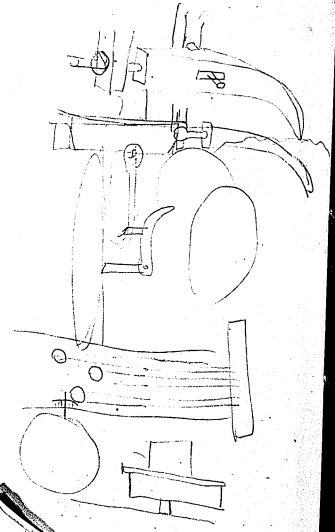
Crucent, Thurs + Fri March 17 1889

89

Asphaltic felt various processes in use Canton with flooring heat also re dipping







Comat pharmacEE Mich 89

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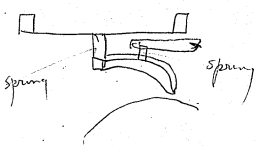
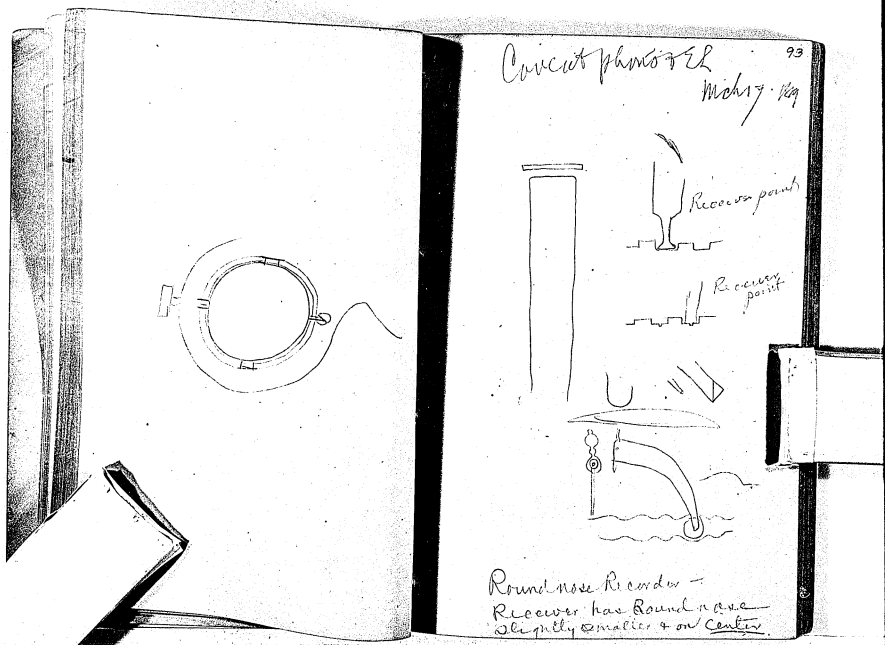
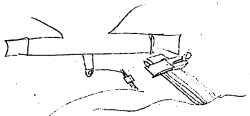



Circuit phenomena
Michigan
93
Receiver point
Receiver position
Round nose Recorder —
Receiver has Round nose
slightly smaller & on Centre

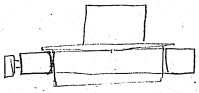
Concert Grand ✓ EB

March 17 1869

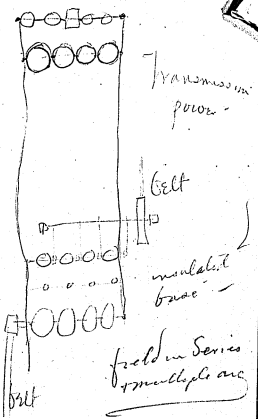


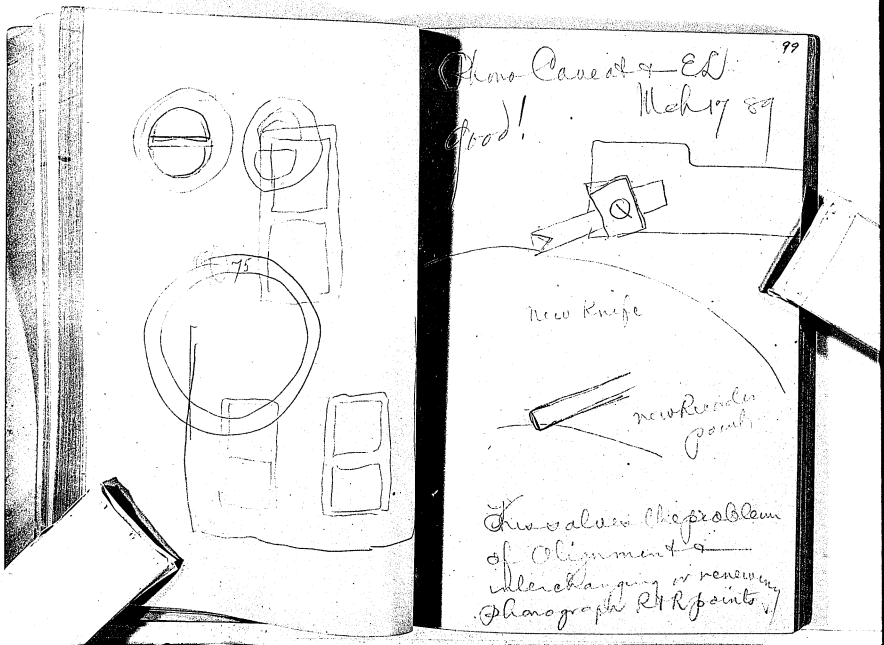
flexible Ribbons brush recess
pointy —

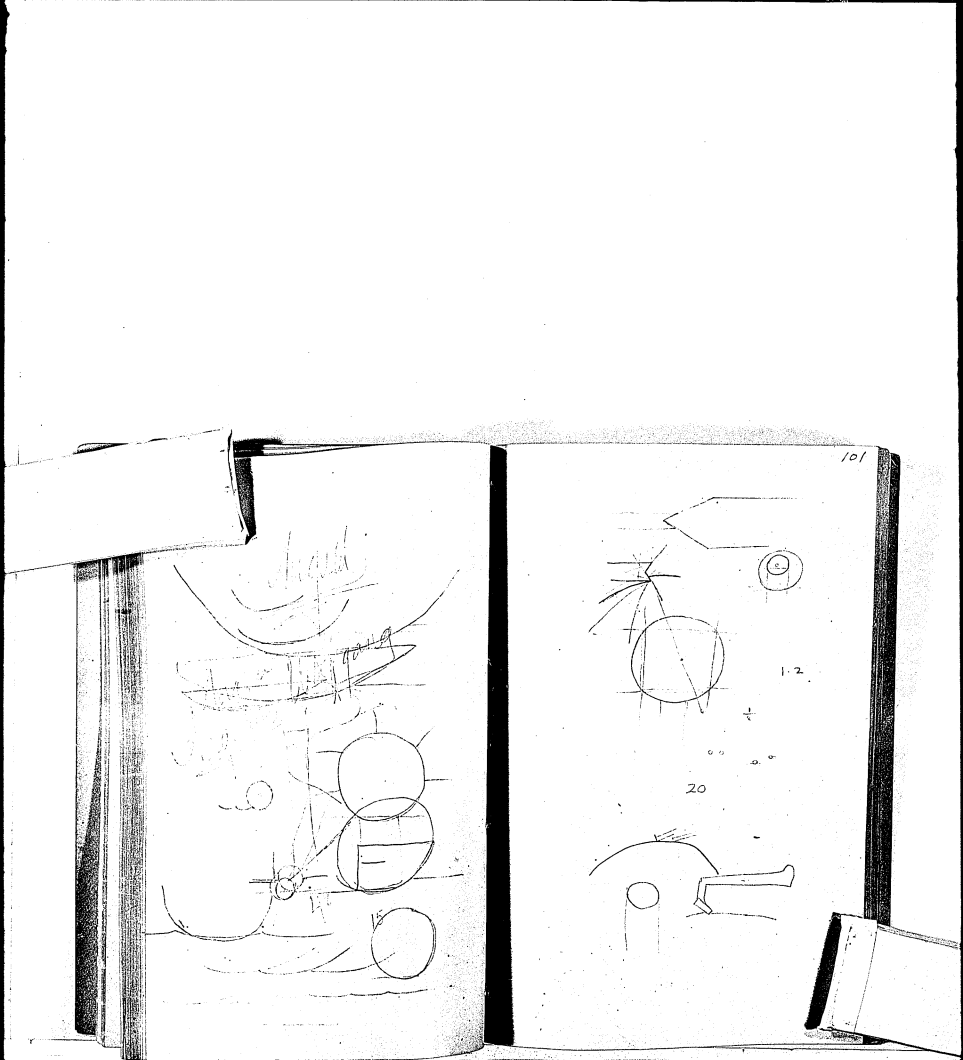
Lead or tin print.

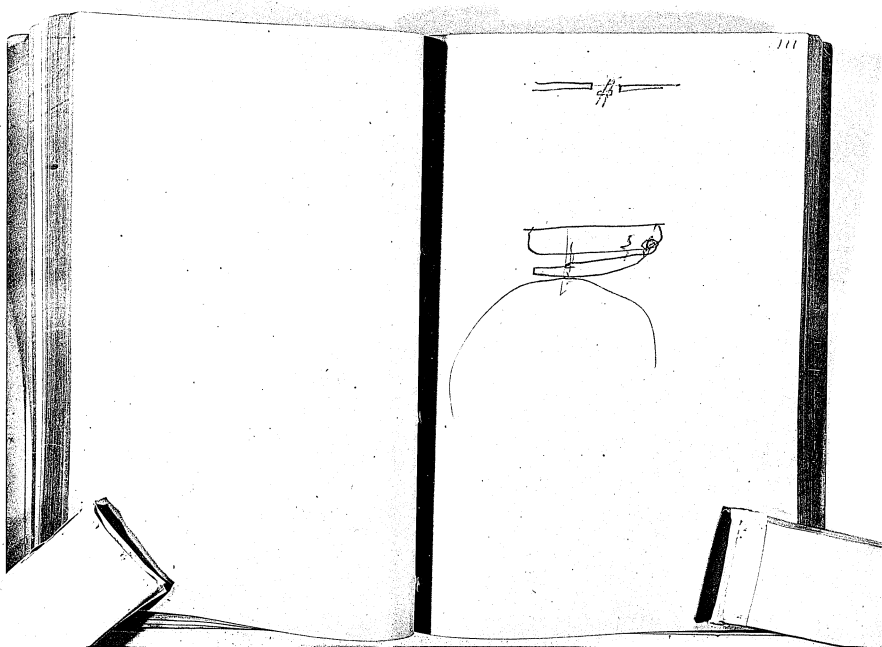


Thurs Ev Concert Mech 17/87




99
Mch 17 89
Good!
New Knife
New Rivets
Compl
Knee valves the problem
of Alignment
Mechanism or renewing
Phanographs RH R points


101
1·2
20



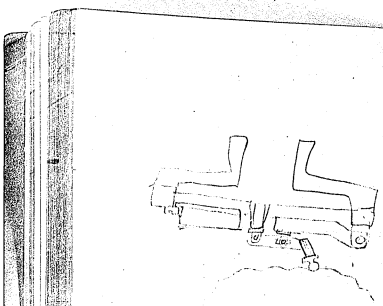
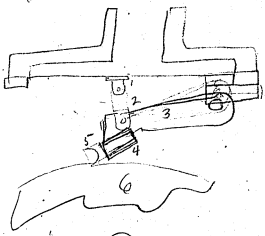


fig 1



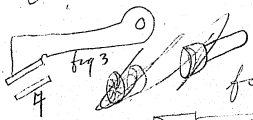


fig 3

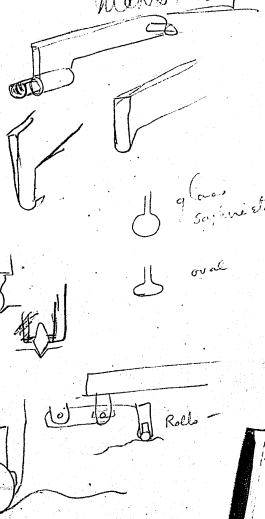
fig 2

The object of the invention is to produce simple and effective recording and reproducing ~~means~~ for phonographs which may be adjusted or removed by inexpert persons and the production of a record differing in respects to the record heretofore made by phonographs so as to be capable of absolute reproduction of the original sound with all its characteristics under advantageous conditions as to adjustment or irregularity of the apparatus

The inscription consists
primarily of the recording
the wounds circularly instead
of square. 2nd. The reproduction
of from one drawing by
a tracing point also circular
~~instead~~ thus rendering
impossible the perfect
alignment as to the ~~point~~
tracing point and record
impossible as well as other
forms of wounds record
Third the use of a circular or
concentric recording
tool, and of a circular or
concentric reproducing
tool for following the
record

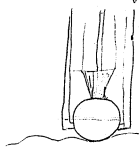
Fig 1 Illustrates the
Recorder

Chemical Glassware
Mahrsh 1884

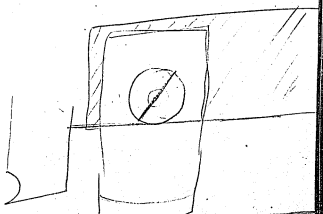


Thema Cam ES

Mch 24 1859 TCS



Rolling Ball Ramp



pinement for carbonizing through a
die like Macaroni can be
made very perfect with proper
material. I employ pitch
asphaltic or Bituminous material
Either natural or produced
artificially as in the
decomposition of Organic
Carbonaceous matter
Salts or Compounds of Chromium
or heat to produce tiny substance
the Various Asphaltic bi-
materials if containing too
much Volatile matter
like such as sulphuretted
or Hydrocarbons containing
a relative large amount
of Hydrogen should be
heated for several hours
in a and bath to
drive off as far as
practicable the Volatile

Phenol Ed Laurent Mch 24 125

constituents and reduce by
the mixture to ~~Hydro~~
Carbon Compounds with
Hydrogen Sulphur or Oxygen
to the minimum quantity
of Hydrogen ~~Acid~~
being in nearly every case
the Hydrogen combined
with the Carbon that
carries the Compound
to fuse easily. after
~~this~~ diminishing the
Carbon Compounds rich
in Hydrogen there will
remain an asphaltic
like residue rich in
Carbon & relatively lean in
Hydrogen. These residues

Phenoglu E.L. Saw Mch 24 89

are known to Chemists
as commence as pitch
~~Bitu~~ The pitches produced
naturally as known as
Asphalts, Bitumens &c
These bodies can be
separated into
fulments for Carbonization
but cannot be Carbonized
directly owing to their
insolubility - Forender
them infusible &c while
in the act of Carbonization
it is essential to still
further dehydrogenize
(1O) take out some of the
Combined Hydrogen

Phmo-Cav Mch 24/89

to that point that the resultant is still a Compound of Hydrogen or Oxygen with Carbon & Capable of being dissolved by some solvent ~~but still if~~ when sufficient Hydrogen has been removed The finest Carbons are driven out of the Compound by heat leaving the filament pure charcoal Carbon without being distorted or swelled. If the Hydrogen has not been sufficiently removed the Material of the filament ~~still~~ will become fused & the gas due to decomposition

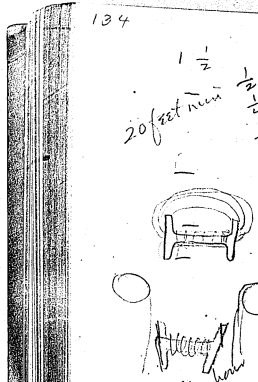
will act while Ex Plimo Teklas mch 24 89
to puff the plastic portion
+ thus distort + rupture the
filament.

After the filament has been
formed from plastic Bitumen
then are acted upon by
chemical reagents which
primarily tend to
displace some of the Hydrogen
from its combination with
the Carbon. Some of the
reagents not only displace
Hydrogen but enter into
combination by a method
known to Chemists as
Substitution, others remove
no Hydrogen directly
but penetrate the mass

Phonograph Lamp 24 89

of the filament & become a volume
ably during Carbonization
of the filament to
displace the Hydrogen
If the filaments are placed
in Kerosene oil containing
say $\frac{1}{20}$ part of Chloride
of Sulphur. The Chlorine
of the Compound with
Eliminate Hydrogen from
the Bitumen probably
some of the Sulphur may
enter into Combination
or remain mechanically
in the pores — the latter
may be removed by
with Nitric acid
after the ~~first~~ ~~action~~

134



20 feet min

500 lbs per foot perhaps

20 / 1600 / 80

500 / 1792.0

2 / 358 feet / 179

6 tons hour

160 / 720

356

Phenol-Ethyl Cavernula 2/4/89

The filaments may thumbe
Carbonized - without distortion
~~about~~ they should remain
in the Benzene bath 200
hours and in the nitric
acid bath 5 pct nitric
95° water for 24 hours
then in water for 96 hours
other Reagents can be used
Nitric acid 5 percent 95
water gradually increase
the strength of the
acid Each Day for 10
days until 75 percent
acid is the final Circuit
Pentachloride of Antimony
dissolved in Chloride
Ethyl acts simultaneously

0150 feet of mag 4 length for 4 Reels

109 sq inst radiuses

53 000 lbs @ 1.325 ~~lbs~~

72.000 sqr in Copper 14700 lbs

Cost $3.100 —

Phmor Ed Saw Mch 24 89

to Chloride of Sulphur

Gut in this case. ~~Chloride~~

of Antimony is deposited

within the pores & must

be removed by Hydrochloric

acid -

Chloride of Bromine

" Iodine

Pentachloride Molybdenum

~~Chlorine~~ & other Carriers

of Chlorine or Bromine

which should by more

of proper Solvents act

to displace Hydrogen

Sulphur also act to displace

Hydrogen with act of

Carbonation the heat causes

the Sulphur to abstract

1325
3,100
750 – Rollfeed & Boxes
100 Dividing board
300 Shutter &c
5 5-7 5-

30 hp required

Blowing Apparatus.

1050 –

Water apparatus 1000

Total 3,575

180 hp saved
3
540
200
1080 Oil Cost to go and

Phens & El Cav Mch 24 69

Hydrogen.

Hydrogen may be displaced from the Combination with Carbon by the use of Oxidizing agents like nitric acid as before discovered Sodic and Potassic oxidizing the Oxide, a great Care should be taken that it will not oxidize the Carbon itself as for instance with Hypochlorous acid

~~Aqua Regia~~ Of nearly all ~~Carbon~~ natural Bitumens Contain ash it is best to purify the pitchy substances by

5000 m bolts saved,
500 m fixing up -
5500 -
3000 - m Mng Eng
8500. Saved -

Showing saving by Iron Mng
+ gain of 67@6¢ or
·008 of this reducing to 30
of Recirculating pumps then,
68@69 + 30 = 25 -

H 1750
2 | 187
93.

Phonotch Law Mch 24 89
dissolving all that can
be dissolved by Chloroform
as this solvent is the
best solvent for the
Compounds
richest in Carbon
by thinning the solution
& filtering most of the
rock is caught by the
filtering paper. The solvent
is then Evaporated off
or better distilled off
leaving it of the same
Consistency as before
& then mixed with
bringing it to the
right Consistency for the

Plaquettes	30
Imprest.	12.
Buttons	8
2 Clove belts	7
Cross belts	2
5lb Hubbells.	5
Big stick	10
Rattle hard	5
Rolls	12
Stamps	50
Mantle	5
Sand Belt	5
Cleaning	5
	156

10
15
10
20
8
7
5
15
5
5
40
5
5
15
30
70

1500

65

160
36
3
5 480
1440
60
4
1700
2000 Cotton

2240
1700
340
1400

Thos & Ed Clarke Mch 24 89

Printing press.

Ammonia process is to dissolve Bitumen by Nitric acid or other oxidizing agent. Hydrogen until Enough Hydrogen has been removed to render them insoluble then dissolving the Compound in a proper solvent such as to remove ash & Evaporate Solvent down to a point where the residue is ready for printing the bitumen will dry hand & may be cast to shape of a loop etc

144

16" 3 / 1.500 — .450 time

24

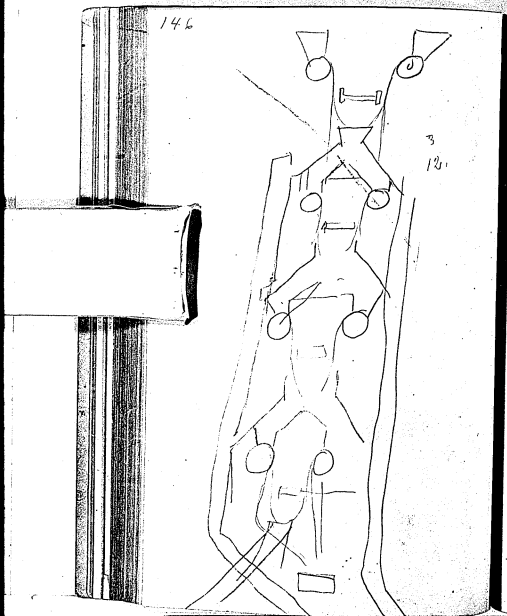
36 / 3 / 108 / 1.500 / 6 / 648 / 108 / 162.00

3 / 2.50 / 83 / 1.67 hour / 3 / 334.

Phenol + Ethl Carbonate 24 Sq

while warm especially just after they come from the press + Carbonyzed without distortion.

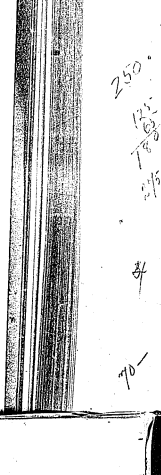
Ordinary Asphalt. Such as Byers or Cuban is easily dehydrogenized + rendered infusible by nitric acid. The powder after washing + drying is valuable in Chloroform especially if a little methylic alcohol is added - to render the drying of the film more slow + thus tend to prevent Cracking.



Thomas Chalmers Morley Esq

15 or 25 per cent of Chloral Hydrate may be added to the powder which is soluble both in Methylated alcohol or Chloroform -

~~All the~~ The exact nature of the reactions taking place in these Bituminous products which ~~are supposed to~~ approach so closely to Charcoal that they can only be distinguished from it by their Capability of being either dissolved or softened by some Solvent or Combination of Solvents ~~from~~ is not Known by Chemists. Very little investigation has taken place as these are disjointed & Contradictory.

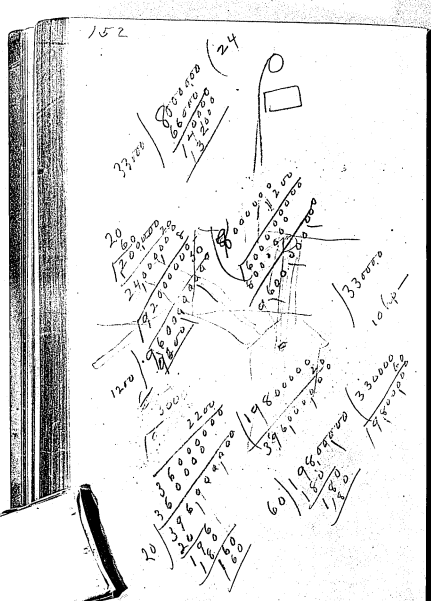


Thomas & Eb Carmichael 24 89

hence no accurate statement is possible & all that I can do is to point out generally - Neither is it possible to give exact quantities or times or temperatures, as all Bituminous residues are of very complex nature & Oxidation changes with every change of temperature or conditions under which they are produced. The gen[illegible] treatment But all can be resolved by heat into compounds ~~that~~ Richer & Richer in Carbon until a point is reached where the heat must be

Phono + Tel Gaz Mch 24 89

discontinue for to prevent final decomposition or Carbonization, and that they are thus plastic + may be organized into filaments and that by chemical agency which serves to render Hydrogen be made infusible while being Carbonized + that the final Hydrogen + other atom of matter combined with the Carbon ~~which~~ is finally driven off + the filament is Charcoal. and that instead of acting on the organized filament after formation

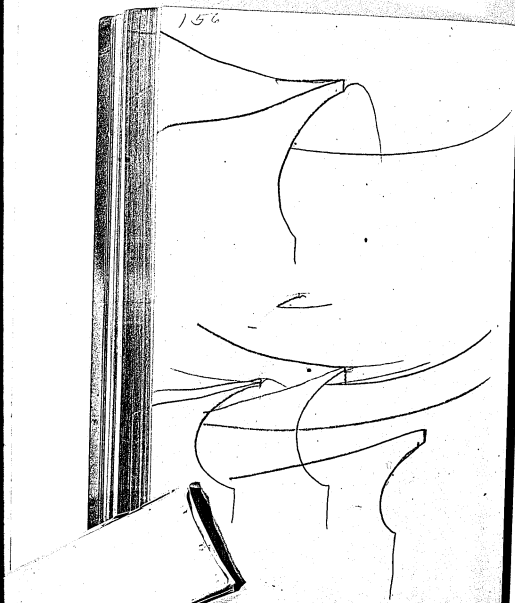


Phenol Ch Gourmehy 89

This action may take
place previous to quantiv
but the fulminate
may still be yielded
as the resultant compounds
of the action of
say Nitric acid on all
The residues of the drum
of the manufacture
Constituents is the
production of a compound
infusible but volatile
in Chloroform or mixture
of Chloroform with acid.
Ether, Methyl alcohol,
Hot Anilide, Nitro Benz,
Chloral Hydrate,
Napthaline, Anthracene

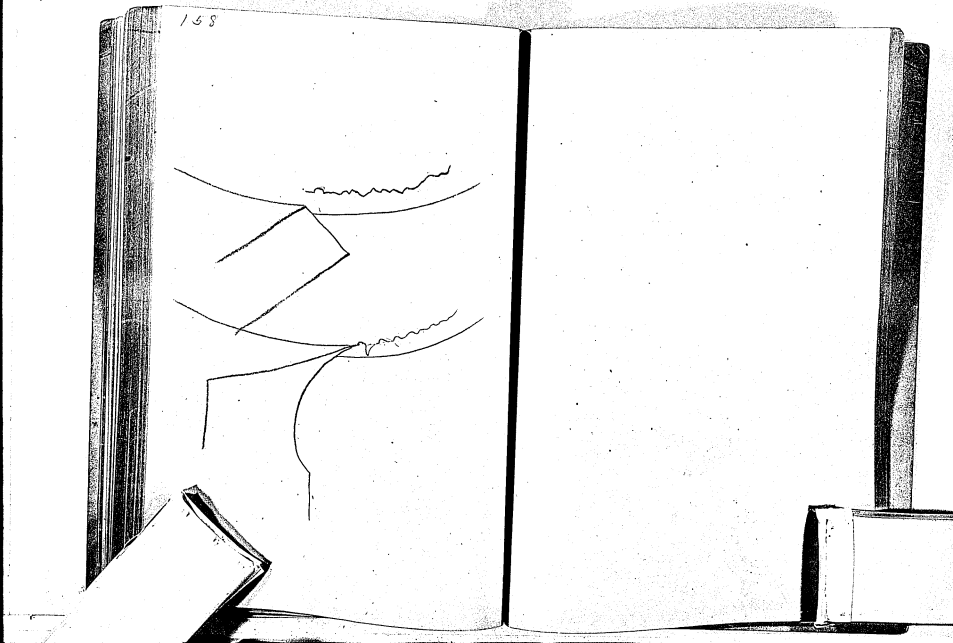
Phono & El Saw mch 24, 89

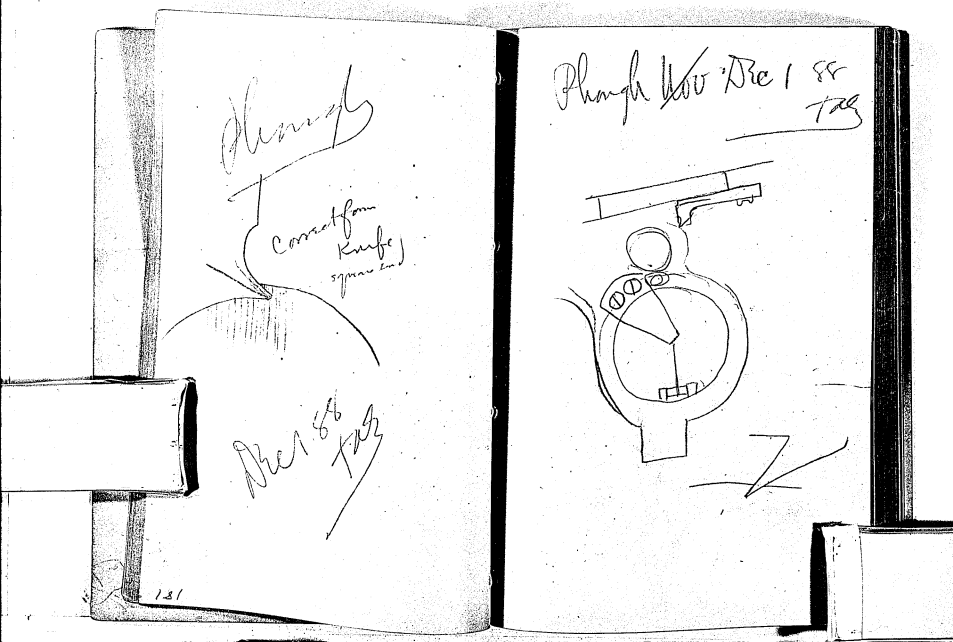
~~Asphalts~~ Bituminous bodies
Can be analyzed & formed
from pure organic materials
free from Asphalts by passing
the vapors through
Red hot tubes & Condensing
the residue & evaporating
to a pitch which is sold
like asphaltum
Sold for melanes
Benzole gives what
is known as Bitumene
The residues due to
the distillation of Enemy
Organic substances
not treated beyond
Carbonization gives
the Bituminous residue



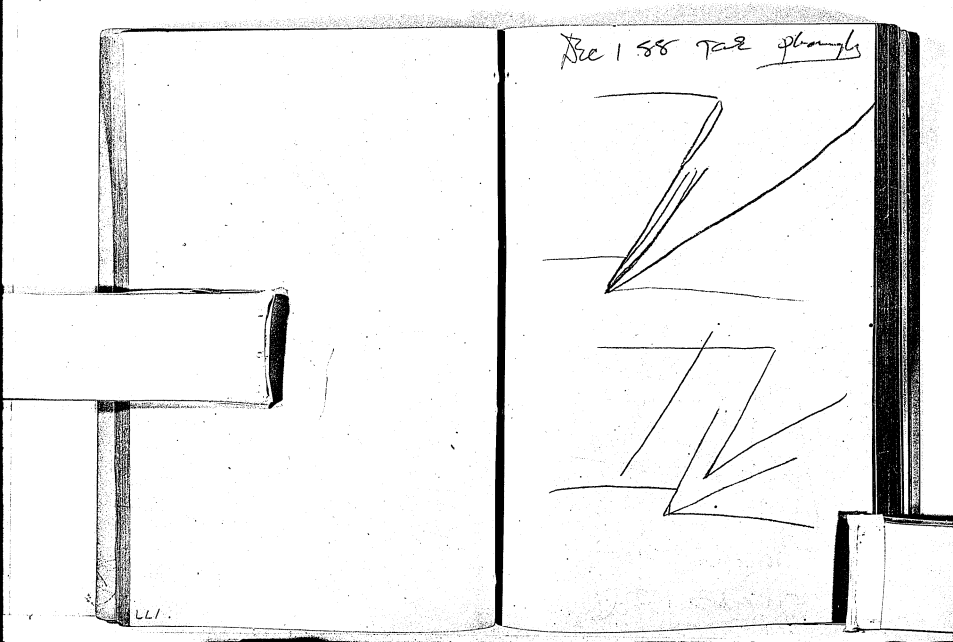
Phonograph E.L. Case-March 24 89

All the Carbon filaments produced by this process change their resistance while giving off light and although not to such an extent as to render the lamps unavailable for giving light commercially no apparent tendency to the Carbon filaments exhibit up to the present time no attempt has been successful to produce Changes of resistance after long burning I believe I can accomplish the result by this process owing to its capability of being made in many ways ~~of~~ different constituents not possible with filaments ~~of~~ from Cellulose now generally used, ~~the Value of~~ filaments which change in resistance very little would be of high commercial Value —




Dec 1 86
TAG
Dec 1 88
TAG

Phenol
Dec 1 88
TAR
Dec 1 88
TAR
Phenol

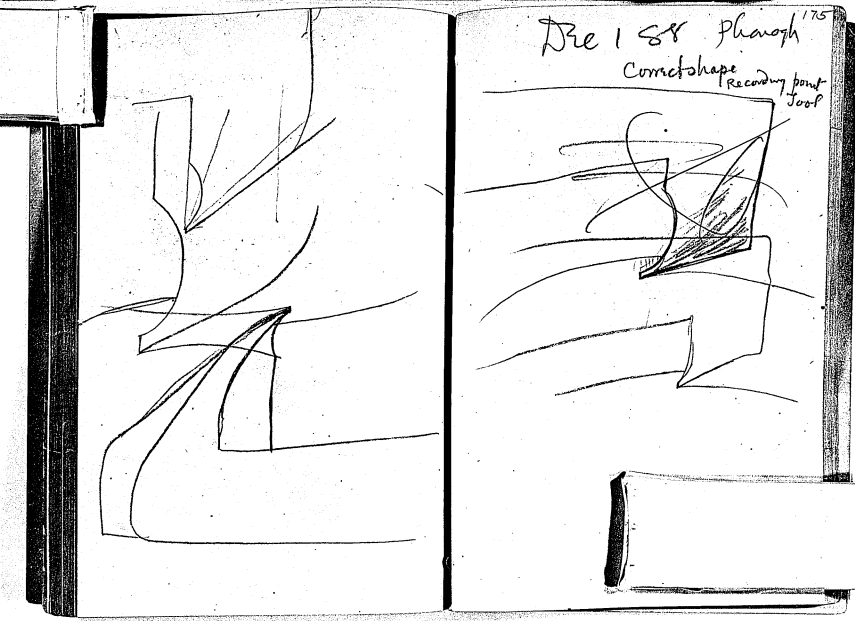

Re 1 88 Tar glossy

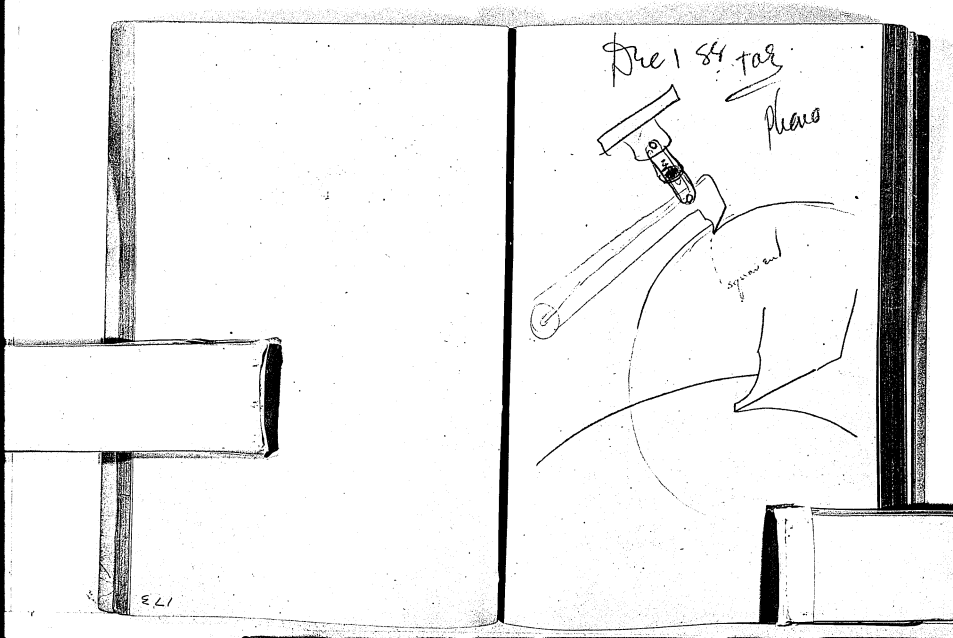
Dre 1 58 Pharaoh

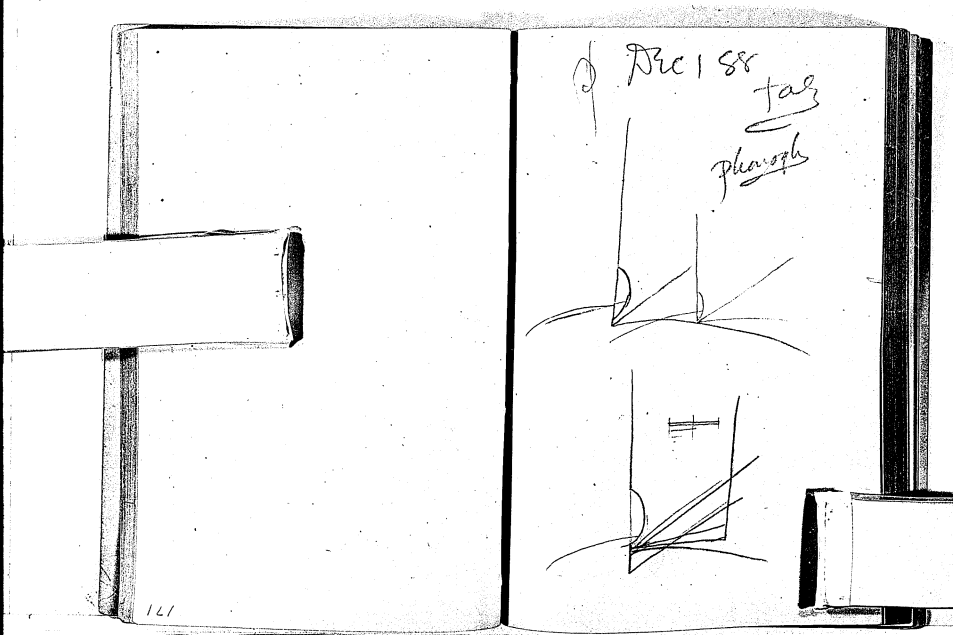
Correct shape

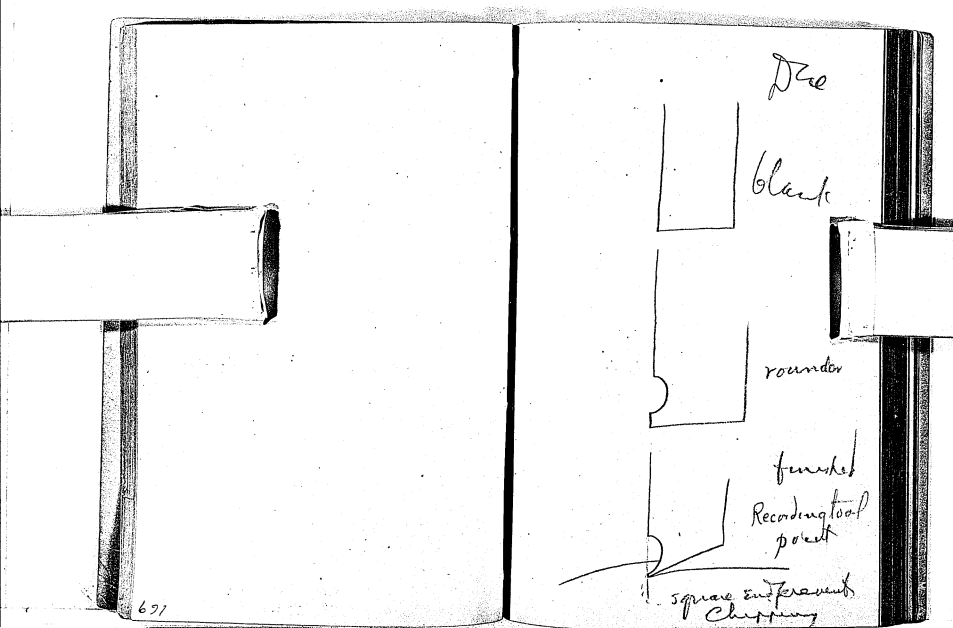
Recording point

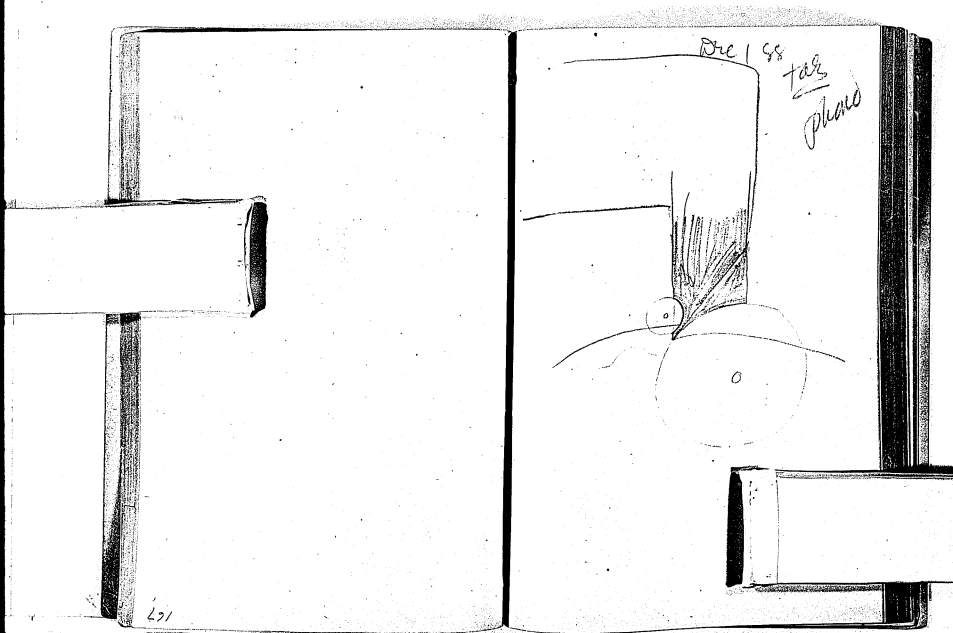
Loop

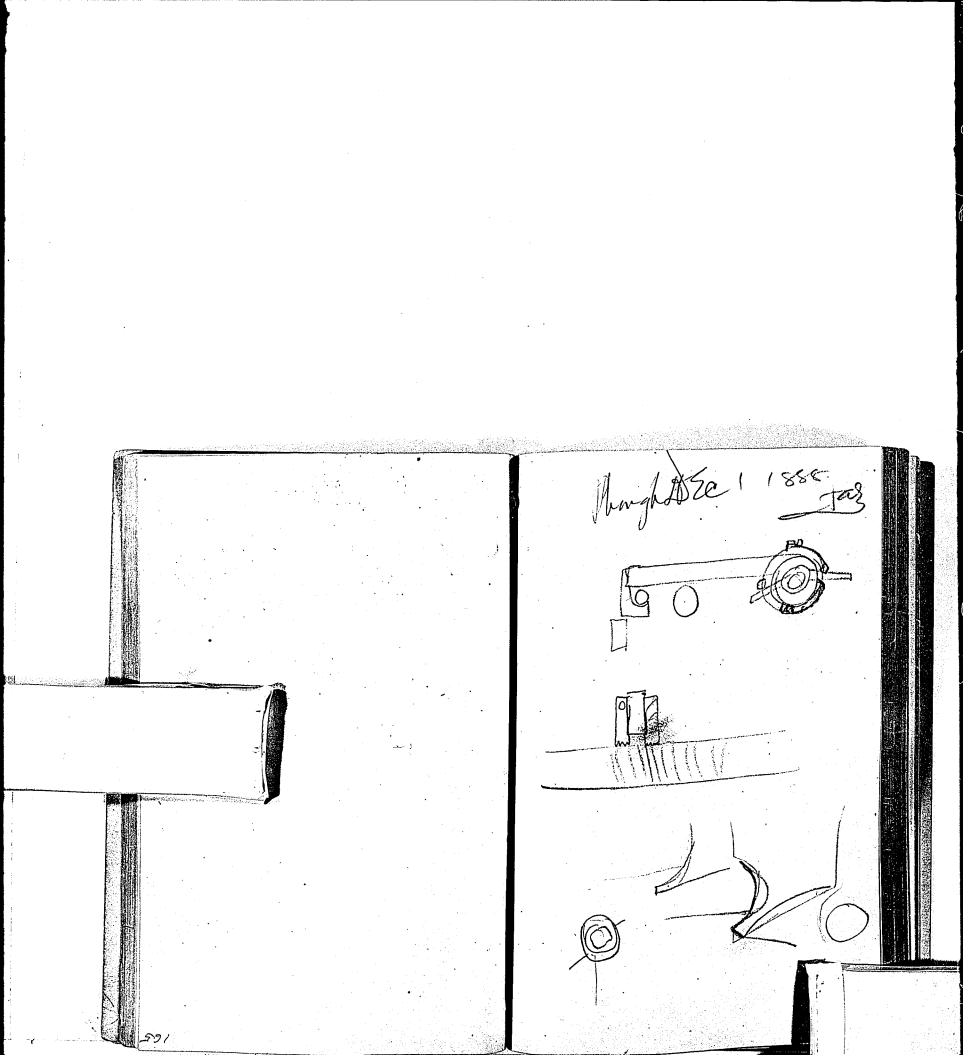


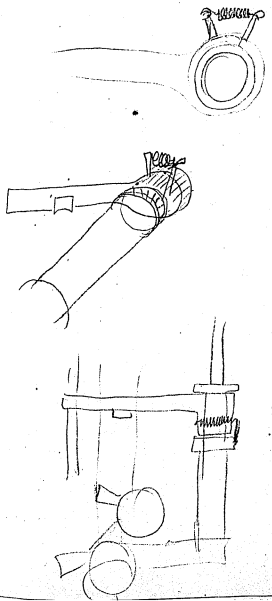

Pre 1 84 tar
Plano
synovial


DEC 188
tag
pharaoh


Die
Blank
rounder
funnel
Recording tool point
square end forming Chipping


Dec 1 68
tail
plane





to give the best results, or the ~~rubber~~ of the reactions is not found to be impossible in the present state of chemistry & besides is unnecessary for carrying out my invention. ~~Strengthening~~

~~The filament is~~ I preferably dehydrate & purge the filament by immersing them in Common Kerosene in which we dissolve one part of Chloride of Sulphur to 20 of Kerosene and allow them to remain for 100 hours – The filament so is nearly insoluble

~~first~~ ~~to remove oil~~ ~~thus~~ the bath ~~if either reagents from the~~ further ~~possession~~ ~~contained~~ in the bath and treated ~~with~~ Nitric acid ~~of eight~~ 5 parts of acid to 95 of water ~~is~~ to 20 ~~of~~ greatly dehydrogenized & the sulphur left in by the reaction is removed by ~~oxidation~~ ~~that the~~ filament does not fracture or distort during carbonization another method of dehydrogenizing is to use a Perchloride of ~~phosphorus~~ sulphur ~~of~~ in ~~Chloride of Ethyl~~ ~~dissolved~~ in about the same proportions as with the Chloride of Sulphur, owing to the great variability of the original material, the best proportion

must be determined for each
lot or kind of material
when the pendrachlorides
used Oxychlorides of Nit-
will be left in the
pores of the fulminat
this may be dissolved
out by hydrochlor
ides. A subsequent
treatment by Nitric
acid compromises the
chemical of the fulminat
still further. —

Detonation of gun cotton may be effected by Nitric acid alone ~~by passing it through a hot tube~~ by the action of the reagent is gradually

In the chemical theories ~~of~~ methods of dehydrogenizing these asphaltic filaments to the point of non fusibility & only mentum a single method which Prince found simple & effective

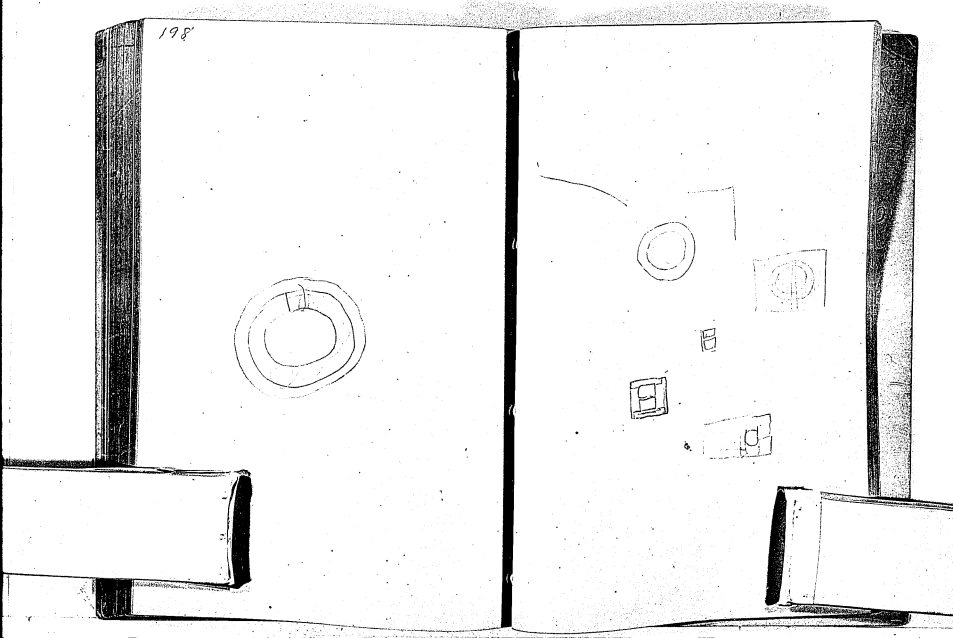
The 2nd method is the partial dehydrogenization of the Asphaltic material before formation into filaments - ~~The material is dissolved in chloroform and then acted on by passing Ozone through the solution. The Solvent~~

~~2nd Page~~

~~Process of the invention~~

The materials are called Asphalt is powdered very fine & thrown into ordinary Commercial Nitric acid & stirred a strong evolution of nitrous fumes takes place ~~—~~ the Hydrogen of the Asphalt being oxidized by the O of the Nitric acid and it is probable that an oxidization of the remaining Hydrocarbons also takes place — the cokale cakes together by

the heat after the reaction
after no more fumes are
given off the lump is
dried and regrounded
and put in a fresh charge
this take place several
times until no appreciable
quantities of nitrous
and Coal gases
the powder is then
washed in water and
dried repowdered to
200 mesh screen & thoroughly
dried. The resultant powder
is then mixed with a
solvent which varies
according to the original
source from which the
Asphaltic substance was
obtained — In the

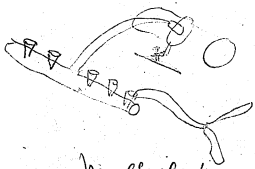

198

Case of Ordinary Baled
asphalt. the powder after
its treatment with Nitric
acid is insoluble in
Chloroform and also
warm Chloral Hydrate
To form the ~~fulminate~~ 9
dissolve the powder in
Chloroform filter the solution
then evaporate or distill
off the chloroform to the
consistency of Molasses
+ then add 10 parts
of Chloral Hydrate to
90 parts of the powder
+ still further evaporate
until it reaches the
consistency of stiff putty
the ~~Lump~~ is ~~to be~~ taken

Kneading through the fingers to remove any lumps & uniformly distribute is placed in the ~~press~~ Chamber of which press the Chamber of which is warmed to about 250 F. ~~the fabric~~ the fabric ~~is~~ ~~evenly spread~~ to cause the Chloral Hydrate to act readily the filament are then Evenly spread to retain their shape perfectly during Carbonization.

Phono & Elec Communication 21 Sep

The Use of Chromium for phono points & Tool-
Use of pure Iron by
Reduction from pure salt.
Say Reduction by Hydrogen
then working into shape
working A steel by
Cementation & then
grinding -



Multiple Insulators

Phmo + E & Law Mch 31/89

Syrian or other Asphaltic Substances heated to drive off all volatile matter that comes off at 300 C then dissolving in Chloroform + filtering — to purify by ash or it may be done previously — then dissolve in Bisulphide after removal of Chloroform + putting in the Bisulphide Enough Sulphur so. as Evaporation of solvent Sulphur will be left mixed intimately with the Asphalt

Carbon Phenol Eh

The amount being sufficient to dehydrogenize the Asphalt & prevent Melting during Carbonization —

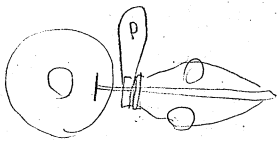
Also the Asphalt may be dried after purification & made into a paste with Chloroform & Strong Sulphuric acid. squirted & the fols. The Sul acid at high temp reduces or Enters into Combn to prevent melting + SO_2 going off as a gas —

Iodine may also be dissolved in Disulphide

of Carbon & an Evaporadem the Iodine will act as a dehydrogenizer -

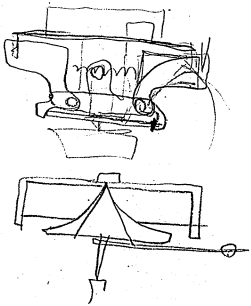
Oxide of mercury can be mixed with the asphaltic material and on Combustion the O will dehydrogenize the asphaltic Material & the Hg will go off in Vapor thus leaving the filament free -

By dissolving the material after heating to drive off the Very Volatile Constituents in Chloroform or other good solvent not materially



acted on by Chlorine.
The Chlorine may be
passed through the
Salulin until maximum
Chlorination or rather
dehydrogenation is
obtained - afterwards
to obtain a higher
or greater dehydrogen
of the material & this
will depend on the
material the salulin
may be treated with
Nitric acid one atom
of O takes out H

214



Certain kinds of asphalt like purified Trinidad or Hard Cuban often purification by solvents wherein the asphaltenes are, may be boiled in a ~~very~~ wide flat dish constantly stirring atmospheric Oxidation takes place at the same time the more volatile constituents are driven off and a point is reached ~~of~~ when the material only remains soft at 400 C. In this state

It may be accumulated in filaments by heat around the disc of the press by slow Carbonization the remaining Hydrogen Can be driven off — the filament fully Carbonized without distortion

I have found as a rule that all that portion which is dissolved out of an Asphaltic residue or mineral Coal like Lignites or Semi Coals is preferable for this purpose to that dissolved out by other Solvents

The greatly dehydrogenized
material of the Asphaltic
or Bituminous Character
Studied has other solvents
Especially when aided
by heat but the solvent
action also greatly depends
on the original nature
of the material oil of which
there is the same & also
on the character of the
reactions involved in
dehydrogenizing it to
the various melting point
among Solvents are
Methyl Alcohol, Chloral
Hydrate, Oil Myrcene
Limene Oil, Oil Camphor
Eucalyptus Oil

Nitric Ether.
Nitrite of amyl-
Sulpho-Hydrocarbon bases
Like. Sulpho-carbymethylamin
oil Mustard & several
other Sulpho Compounds.

Hollow filaments may
be quilted in the same
manner as leadflips
& hollow Macaroni.
The advantage of hollow
filaments are great with
Large Candle power lamps
as it gives a more even
Carbonization throughout
the mass -

A carbon filament made of a ~~from matter produced by the material~~ from asphaltic material

A ~~Carb~~ filament for ~~forming~~ Carbonization ~~of forming~~ of plastic material ~~of asphaltic from~~ from a plastic mass.

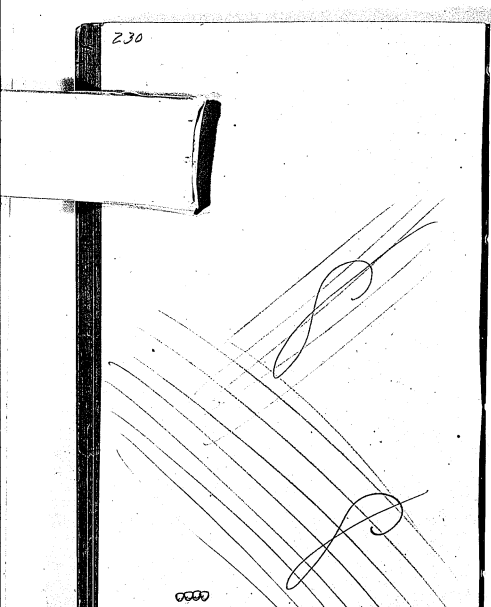
A carbon filament made ~~if from~~ of the ~~the~~ residues from the destructive distillation of organic matter artificially or naturally ~~of~~ Asphaltic or Bituminous material

A filament for Carbonizing formed from a plastic mass known as pitch asphaltum or Bituminous matter and adapted to be rendered infusible before Carbonizing by chemical agency.

A filament of Carbon made from the cellulose decomposition products of Organic material known as pitches asphaltums or Bituminous matter

A filament for Carbonizing formed from a plastic mass of material such as asphaltum or Bituminous matter acting upon such filament by Chlorogen or Oxidizing agent to render it infusible while being Carbonized

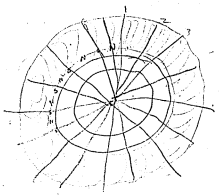
~~(A filament for Carbonization~~
~~Consisting of a plastic~~
~~Carbonaceous~~ plastic material
capable of being rendered
by heat or Galvanic forces
&c, filaments, and then
subjected to ~~a further~~
~~Coke~~ a chemical action
whereby that Element
which renders them
fusible is displaced



A filament of Carbon for an incandescent lamp made from the ~~[illegible] decomposition products of organic [illegible]~~ Known pitchy Asphaltic or Bituminous products from the decomposition of organic material either anhydrous or natural,

Same add - ~~[illegible]~~ made infusible before carbonization;

Same - dehydrogenized ~~by~~ chemical agency to render bulk compounds infusible during the act of Carbonization.



762

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amidosulphobenzoic acid

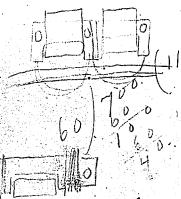
dark violet, Carbon gas

dissolves easily ammonia

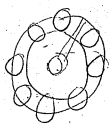
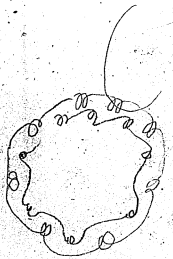
Watts 455 —

Sulphonaphthalene for
mountain Watts

522 x 3.



CO_3

$Na_2 CO_2$ Na CO
Na CO

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